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Climates of the British Empire suitable for the Cultivation of Cotton.

By C. E. P. BROOKS, M.Sc.

COTTON is a sub-tropical plant which probably originated in the Eastern Mediterranean, but it has become so thoroughly naturalised in the Southern States of America that they must be considered as having the most suitable climate for the commercial cultivation of the plant. The cotton belt includes the States of Tennessee, Alabama, South Carolina, Louisiana, Texas and Oklahoma. The climatology of these regions has been described in two important papers.*

The essential features of a cotton-growing climate are :—(1) The mean annual temperature should not be below 60° F. (2) The mean temperature of the warmest month should exceed 80° F. or the mean of the three warmest months should exceed 77° F. to get the best results; this condition, however, is not so important as the first. (3) The interval between killing frosts (or droughts) should be at least 200 days. (4) The annual rainfall should not exceed about 60 inches for good crops, though cotton of a poorer quality

* Washington, D.C., U.S. Dept. Agric., Bull. No. 8. Report on the climatology of the cotton plant. By P. H. Mell, 1893.

Stine, O. C., and Baker, O. E. Climate of the cotton belt. Washington, D.C., U.S. Dept. Agric., Monthly Weath. Rev., 47, 1919, p. 487.

a (64)10638 Wt 105—P 35 1125 4/20 E & S A 2

can be grown in much wetter climates. Unless irrigation is possible the annual fall should not be less than 23 inches. (5) There must be plenty of bright sunshine. A dull and humid atmosphere is particularly unfavourable to the cotton plant.

In the cotton belt of the United States the rainfall lies in almost all parts between 23 inches and 60 inches. The mean annual temperature nowhere falls below 60° F., and the warmest month always just exceeds 80° F.

In the British Empire these conditions are found in their entirety in parts of India and in the West Indies, which are already important cotton-producing countries. Other colonies whose annual rainfall lies between the specified limits may be considered in greater detail.

Uganda, represented by Entebbe, lies at an elevation of more than 3,000 feet, and the heat natural to a place on the equator is reduced by this elevation, so that the temperature is rather below the specified temperature for the warmest month, but the remarkable uniformity both in temperature and rainfall throughout the year should counterbalance this and enable cotton crops to be grown with reasonable success.

Nyasaland is represented by Zomba at a height of 3,000 feet. The annual rainfall is 55 inches with a well-marked dry season. The summer temperature is nearly 75°, and cotton has been tried experimentally with some success. On the lower ground near Lake Tanganyika and the Shire River it should do very well, and only lack of transport is against successful commercial cotton production.

Gambia.—Bathurst has a very suitable climate except for the length of the dry season and the excessive rain in August. Cotton should do well, however, as an irrigated crop in the dry season.

The Soudan, as represented by Wau, has a very favourable climate, and cotton should do well. In the drier parts irrigation would be necessary.

Nigeria.—The coastal regions of Nigeria, represented by Lagos, appear to be too moist and rainy for the successful growth of high quality cotton, but further inland, as at Zungeru, conditions appear to be excellent.

Gold Coast.—The rainfall of this colony is very variable, but is less than that of the Nigerian Coast, and cotton should do well.

Rhodesia, represented by Salisbury, has a very similar climate to that of Zomba, and cotton should do well in the low-lying parts of the colony.

British East Africa consists of a low coastal region (*c.f.* Zanzibar) and the high Kenia plateau (Nairobi). The plateau is generally too high, but some cotton can be grown in the coastal belt; generally, however, the rainfall is too heavy for a commercial crop.

The Union of South Africa as a whole has a climate unsuited to the cultivation of cotton, being hardly warm enough and having also sparse and irregular rains. The east coast, however, including Natal, is far more suitable.

Australia.—The Northern Territory is only just too wet, and the coast of Queensland seems suitable. Further south, New South Wales and Victoria, where cotton has been tried and has not been a success commercially, are barely warm enough. The wetter parts of West Australia should be successful with Egyptian cotton, but without irrigation the interior is too dry.

New Guinea.—An untouched source of supply, probably of great value, is to be found in New Guinea, where the climate of the southern coast is very suitable, and where a native cotton of good quality already exists.

The colonies such as *Sierra Leone*, *Borneo*, *Fiji*, *Seychelles*, *British Honduras*, *Ceylon*, *Straits Settlements* and *Guiana* are in general too damp for the commercial production of good quality cotton, though probably some cotton for native use is grown in most of these colonies. On the other hand, Cyprus and Malta have too little and too irregular rains for the successful growth of cotton crops without irrigation. The case of Lower Egypt need not be referred to; in Upper Egypt the air seems to be too dry even with proper irrigation.

Royal Meteorological Society.

ON Wednesday, March 17th, a lecture was delivered before the Royal Meteorological Society by Captain C. K. M. Douglas, at the rooms of the Royal Astronomical Society, on "Clouds as seen from an Aeroplane." Some of Captain Douglas's photographs of cloud, taken whilst observing for the Meteorological Service in the North of France, have already appeared in *Symons's Meteorological Magazine*. Many others were used to illustrate the lecture, and details of the meteorological conditions associated with the various types were discussed.

The lecture will be printed in the *Quarterly Journal* of the Royal Meteorological Society.

The Royal Society.

AT the meeting of the Royal Society on February 26th, Mr. L. F. Richardson read a paper on "Some Measurements of Atmospheric Turbulence."

The movement of small floating particles such as smoke or the parachutes of plant seeds is considered by the author. If the particles start from a fixed point and the standard deviation of their heights after a certain time is estimated, then, as shown by Osborne Reynolds, provided the time is short, the standard deviation is proportional to the time. On the other hand, when the time is large, the standard deviation is proportional to the square root of the time in accordance with the theory of eddy conductivity.

The author's measurements show that the diffusivity (the K of Taylor's theory) increases greatly with height in the first kilometre. Reasons are given for supposing that it is useful to assume in general that the conductivity of air for water vapour is equal to the viscosity, and the fitting methods for measuring each by smoke are contrasted.

Official Publications.

Climatological Diagrams, M.O. 3096. 60 copies, 7s. 6*d.*; post free, 7s. 10*d.*

In response to the demand from observers for a climatological diagram on which daily readings can be displayed graphically, a new form (M.O. 3096) has been prepared. Provision is made for the readings for one week, and it is suggested that the diagrams for the past and current weeks should be exhibited together so that the progress of the weather for at least seven clear days may be seen. The charts have the advantage of a more open scale than can be obtained in the customary monthly charts.

Soundings with Pilot Balloons in the Isles of Scilly, November and December 1911. Geophysical Memoirs, No. 14, M.O. 220d. By Captain C. J. P. Cave, M.A., and J. S. Dines, M.A. Price 1s. 6*d.* net.

The Climate and Weather of the Falkland Isles and South Georgia. Geophysical Memoirs, No. 15, M.O. 220b. By C. E. P. Brooks, M.Sc. Price 3s. 6*d.* net.

The two Memoirs mentioned above have just been published. A short account of the subject matter of each will appear in the next number of the Magazine.

Meteorological Stations.

A LIST of new stations of the Meteorological Office is given below. Three of the stations, namely Croydon, Didsbury, and Biggin Hill, have been established recently. The others were established by the Royal Air Force during the War, and their reports have been utilised continuously in the Daily Weather Service. The normal equipment of these stations includes anemograph, barograph, thermograph, hygrograph and hyetograph, but Beachy Head is not provided with autographic instruments. Biggin Hill is a kite-balloon station.

County.	Station.	Lat.		Long.		Height in feet above M.S.L.	Officer in Charge.
		°	′	°	′		
Dublin -	Baldonnel -	53	18	6	26 W	300	Lieut. J. J. Somerville.
Lancashire -	Didsbury -	53	26	2	13 W	99	Capt. G. H. L. Douglas-Lane.
Lincolnshire	Cranwell -	53	2	0	31 W	233	Capt. W. H. Pick.
Norfolk -	Howden -	53	47	0	52 W	19	Lieut. Guy Harris.
Suffolk -	Felixstowe	51	57	1	20 E	15	Lieut. A. Walters.
Kent - -	Lympne -	51	5	1	1 E	340	Lieut. R. S. Read.
Hampshire-	Calshot -	50	49	1	18 W	12	Capt. H. W. L. Absalom.
Surrey -	Croydon -	51	21	0	7 W	242	Capt. G. R. Hay.
Sussex -	Beachy Head.	50	44	0	15 E	525	Chief Officer Coast-Guard.
Kent - -	Biggin Hill	51	19	0	3 E	610	Mr. T. H. Applegate (Observer).

Retirements.

Mr. Henry Harries, who is a native of South Wales, joined the staff of the Meteorological Office in May 1875 as a Temporary Clerk, has been identified with the work of the Marine Division and the preparation of Monthly Meteorological Charts of the Oceans, and also with the work of Weather Forecasting and Storm Warning.

He began his service in the Marine Division under Captain Toynbee, and continued with Marine Meteorology under Captain Hepworth until, on promotion to Principal Assistant in 1903, he was transferred to the Forecast Division. He continued in that division until February 1919, when, on the death of Mr. Allingham, he returned to the Marine Division.

In May of that year he was promoted Assistant Superintendent, a post which he held until his retirement on 31st March 1920.

Mr. Harries has written numerous papers on meteorological subjects, and for many years he acted as correspondent to the *Morning Post.*

Mr. T. Duncan Bell joined the staff in November 1869, at the age of 15, as a Temporary Clerk, and was attached to the Observatory Branch under Mr. Samuel Jeffery. He was shortly after transferred to what was then the general office or correspondence department under Mr. J. S. Harding, the Chief Clerk, whom he assisted in the care of the Library. The entire charge of the Library subsequently devolved upon him, and from 1906, when he was promoted to Principal Assistant in the Statistics and Library Branch, he dealt also with inquiries of all kinds, personal and by letter, under the supervision of the Superintendent of Statistics.

These duties were maintained until April 1914, when he succeeded Mr. J. A. Curtis as Chief Clerk, a position which he held throughout the difficult period of the War until his retirement, 31st March 1920, after 50 years and 5 months of service.

Obituary.

News is received of the death on March 13th of *Mr Thomas William Backhouse,* of West Hendon House, Sunderland, in his 78th year. Like many of the members of the Society of Friends, Mr. Backhouse devoted a very large part of his long life to scientific pursuits and carried on for more than sixty years an elaborate series of meteorological and astronomical observations. A great part of the results of these observations he condensed into a valuable book, published in 1915, containing summaries of records for 50 years. Amongst his original investigations was a discussion of the amount of rain falling with wind blowing from the various points of the compass. The position of Sunderland on the East coast of Great Britain gives a peculiar interest to the work as showing that at a station so situated a high proportion of the rainfall is associated with breezes from the North Sea. Elected a Fellow of the Royal Meteorological Society in 1892, Mr. Backhouse served as Vice-President in 1918 and 1919.

We learn with deep regret of the death on February 20th of *Mr. Maxwell Hall,* Government Meteorologist of Jamaica. Mr. Maxwell Hall was by profession a Barrister-at-Law and Resident Magistrate for the district of Hanover, but his interest in meteorology and astronomy was very keen, and it

is entirely owing to his work that our knowledge of the weather of Jamaica is on a better basis than that of any other West Indian island. His efforts in this direction date back to 1878, and after two visits to London, in the course of which the matter came before the Meteorological Council, he succeeded, in 1880, in obtaining the establishment of the Jamaica Weather Service, with a subsidy of £150 per annum, out of which he had to pay £50 to an observer and to meet other expenses. The objects of the Service were to encourage the recording of rainfall and to foretell the approach of hurricanes, in both of which he was eminently successful. It is interesting to note that considerable use was made of spectroscopic observations.

The first monthly weather report was for the month of June 1881, and the series has been continued without interruption until the present day, though the subsidy was discontinued from time to time. In 1891 appeared the first edition of the Rainfall of Jamaica, a foolscap volume with full page monthly maps, based on data at 153 stations. This was reprinted in 1911, when 194 stations were available with records covering at least ten years. The discussion of the data is very complete, and the whole forms a model piece of work. Other publications include a Report on the Barometer in Jamaica (1911), reports on earthquakes and numerous descriptions of various West Indian hurricanes. In 1904 appeared a general description of the Meteorology of Jamaica. It is very greatly to be hoped that this fine record of work will not be interrupted by the death of its originator.

The Study of Atmospheric Physics.

(Extracts from a memorandum by FRANK H. BIGELOW.)

ATMOSPHERIC Physics divides into several branches, commonly known as Meteorology, Solar Physics, Atmospheric Electricity, Magnetism, Radiation, Electron-dynamics.

There are ten fundamental laws which must be satisfied simultaneously by the data derived from the observations made in all the branches. They are:—

1. The Boyle-Gay Lussac Law in non-adiabatic media.
2. The First Law of Thermodynamics.
3. The gravity balance equation in atmospheres.
4. The kinetics of molecular energy.
5. The Poynting Equation of transformation.
6. The Stefan Law of Radiation.

7. The Maxwell Spectrum Distribution Law.
8. The Wien-Displacement Law.
9. The Maxwell Laws of Electro-magnetism.
10. The Law of Electron-atom-molecular Dynamics.

During 50 years these observational data and these laws have been *disjecta membra*, lacking an organic unity to make them harmonious. The reason for this unsatisfactory state of the Science of the Atmosphere is that there has been no unifying analytic system sufficiently comprehensive and exacting to accomplish this purpose. The empirical processes have unduly received attention and support because of their simplicity and public utility.

During the past ten years my research has gradually built up a successful body of formulæ which now have the power to weld these separated subjects into one harmonious system. Years were spent on statistics, other years on the well-known analytic discussions, but these were never found to fit together. Then a new beginning was made such that the Boyle-Gay Lussac Law should fit exactly in the atmospheric strata that are under observation. From this foundation the structure implied in the ten fundamental laws has been developed step by step. This has involved a radical departure from many of the ideas that have been in circulation for many years, notably from the Abbot value of the solar intensity of radiation, the Planck workungsquantum, the Bohr non-radiating orbits, the Rutherford heavy nucleus, the entire series of observations made by the several national services. On the other hand, we compute the radiation at any point in an atmosphere where the temperature is known, the spectrum distribution (in part), the electric and the magnetic fields, the electron and atomic orbit, &c. The subject is very extensive, complex, difficult to popularise, especially among non-mathematical circles. The possibilities of the new fundamental laws are limitless theoretically and practically.

The pressing question is how to get the world generally on this new procedure. Leagues, unions, societies with brief rare sessions are impractical. What is needed is a small body of experts for a few years to clarify, verify, prepare literature, and gradually reform the entire procedure of atmospheric physics.

January 23rd, 1920, Pilar, F.C.C.A., Argentina.

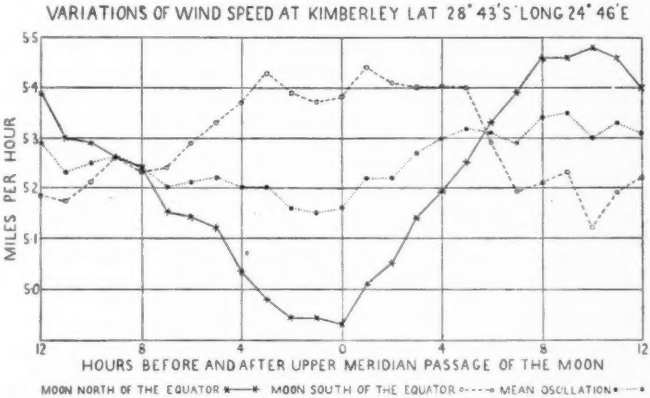
Prof. Bigelow's views are set out more fully in his books (*a*) Treatise on the circulation and radiation in the atmospheres of the Earth and of the Sun. New York, 1915. (*b*) Treatise on the Sun's radiation. New York, 1918.

A summary of the latter by Ellsworth Huntington appears in the *Geographical Review*, December 1919, p. 350.

Dr. J. R. Sutton's Researches.

TWO short papers by Dr. J. R. Sutton, appearing in the Transactions of the Royal Society of South Africa,* open up interesting lines of investigation. In the first he looks for a relation between the temperature of June at Kimberley and the rainfall of the last half of May, and finds that the mean daily range of temperature is greater in the Junes following Mays with rainfall below normal than in those which follow Mays with rainfall above normal. The generalization breaks down only once in the fourteen years considered. The difference in daily range between the two sets of Junes averages 2° F. Dr. Sutton attributes the difference to the state of the soil, the greater temperature range corresponding with dry soil, but it would have been interesting to learn how far variations in the cloud amount and the duration of sunshine would account for the varying range of temperature. The largest June range, 32°, occurred in 1916, when there was no rain at all in the 46 days, May 16—June 30, and the smallest, 25·5°, when there was 2·17 in. in the same period.

In the second paper an attempt is made to trace the influence of the moon on wind-speed. Hourly values of wind-speed as recorded at Kimberley were entered according to lunar time and averages covering 180 lunations were worked up.



* Vol. VIII., Part 1, 1919. (1) A note on the possibility of long range weather forecasts. (2) A possible lunar influence upon the velocity of the wind at Kimberley.

In our diagram, which has been drawn to represent Dr. Sutton's results, two curves show the variation of wind through the lunar day (*a*) when the moon is south of the equator and (*b*) when it is to the north. It will be seen that in either case there is a single oscillation in the lunar day, but that it is reversed with the lunar declination. With the moon north of the equator, the wind is least when the moon is crossing the meridian, low down in the north, and greatest as it approaches the nadir. With the moon south of the equator there is a smaller range, but the wind is strongest with the moon near the zenith and weakest at lunar midnight. In connexion with the fact that there is no indication of a 12-hour period in the wind, Dr. Sutton remarks that "it is "worth notice that when the moon's declination, north or "south, is greatest, the semi-diurnal lunar atmospheric tide "at Kimberley practically disappears, resolving itself into a "single oscillation, the phase when the moon is north being "nearly the reverse of that when the moon is south," but gives no reference to the publication of the work on which this interesting statement is based.

This reversal of the type of oscillation according to the position of the moon is very striking, and one's first feeling on reading the paper was surprise that the author had not shown more enthusiasm for his discovery, but a closer examination reveals the fact that no allowance has been made for the influence of the sun on the wind, which influence is not eliminated automatically by the method of grouping the observations. As the path of the moon is nearer to the ecliptic than to the equator, it follows that at the Kimberley midsummer the moon when it has south declination is near the sun, so that the Upper Meridian Passage is approximately at noon. Thus for the broken curve the hour indicated by 0 in our diagram corresponds roughly to noon in summer and to midnight in winter, and, as the range of the diurnal variation of wind is greater in summer than in winter, the summer type prevails when the observations for the year are averaged. Similarly, for the unbroken curve the reading at the hour 0 is found by averaging night hours in summer and day hours in winter.

It is doubtful whether this explanation leaves room for any direct influence of the moon on the wind. The result of averaging all the observations is shown by the dotted line, which indicates a variation of only 0·2 mi/hr. in the course of the lunar day.

F. J. W. W.

NOTES AND QUERIES.

The Reform of the Calendar.

IN a letter to *Nature*, Professor Flammarion draws attention to the proposal set out in the *Annuaire Astronomique* for 1920 for the reform of the Calendar. He proposes to divide each quarter of the year into months having 30, 30 and 31 days, respectively, each quarter beginning on a Monday and ending on a Sunday. The 365th day of the year is not to be allotted to any week and the same remark applies to the extra day of leap year. These special days are to come at the beginning or end of the year, and may perhaps be counted with January and December, respectively. The Meteorologist will probably look with some suspicion at a proposal which would lead to such a serious break with the past: otherwise he would certainly welcome the abolition of the short month of 28 days which is so troublesome to allow for in all statistical studies.

International Weather Symbols.

AMONGST the matters dealt with at the International Meteorological Conference in Paris in October 1919 was the introduction of additional weather symbols. The symbol for mirage suggested by Sir Napier Shaw in the M.O. Circular No. 26, was adopted. For sleet the symbol which combines the signs for snow and for rain, was accepted. A proposal to modify the symbol **V** for rime which is likely to be confused with the letter *v*, used for exceptional visibility, was not entertained favourably, but the difficulty was met to a certain extent by the adoption of a new symbol for exceptional visibility.

The "Standard Atmosphere" for Aeronauts.

TABLES for the conversion of barometric pressures into heights have been issued recently by the International Aeronautical Federation.* These tables are to be used for the comparison of the performances of aircraft; it is assumed apparently that the merit of a particular flight is to be judged by the pressure which is reached rather than by the

* *Table De Conversion Des Pressions Barométriques en Altitudes.* Fedération Aéronautique Internationale, Paris.

actual height above ground. Thus the observed pressure being equivalent to 160 mm., the aeronaut is to be credited with the height 11,208 metres given in the table, though the actual height above mean sea level which he has actually attained will have been much less than this if the flight is undertaken under cyclonic conditions in winter, much greater if it is under anti-cyclonic conditions in summer. The system has the great advantage that the single reading of the aneroid barometer suffices to determine the conventional "height," whereas a knowledge of the temperature at every level is required if the true height is to be found. Certainly the height as given in these tables is much closer to the truth than that which would be shown by an altimeter standardised, as is customary, for an atmosphere with the uniform temperature of 50° F.

The tables to which reference has been made are computed from a formula put forward by M. Rodolphe Soreau,* which is based only on the 40 soundings made at European stations in the first six months of 1912; the approximation to the mean values for Western Europe computed by W. H. Dines is only moderately satisfactory. M. Soreau's formula, which it may be noted was intended by its author to be valid when the pressure at sea level was 760 mm. of mercury, is

$$z = (15320 + 8{\cdot}65\,P - 0{\cdot}0055\,P^2)\ \log\ (760/P),$$

where z is the required height in metres and P the pressure in millimetres.

The difference between the F.A.I. table and Mr. Dines's averages as given in the M.O. Glossary, p. 54, amounts to nearly 5 mb. both at 5 km. and at 10 km., the discrepancy in heights at those levels being 140 metres and 70 metres respectively. Meteorologists will hope that the matter will be reconsidered before the system of estimating height becomes stereotyped. A satisfactory agreement as to the relation between the conventional "height" and the pressure would provide a better basis for the graduation of altimeters for aeronautical use.

In so far as the merit of the performance of aircraft is concerned it is to be borne in mind that the efficiency of the engine and the lifting power depend on pressure and temperature; the rate of ascent and the air-speed at given pressure and temperature are the things to be compared for different machines. It would facilitate clear thinking on the subject if this fact were recognised explicitly. It is perhaps more striking to learn that an aeroplane has flown in air at pressure 300 mb., or three tenths of the sea-level pressure, than to be told that it attained a height of 25,500 ft.

* *Comptes rendus de l'Académie des Sciences*, December 1919, p. 1024.

Winter in Tristan da Cunha.

INFORMATION has been received of the visit of the *Yarmouth* to Tristan da Cunha, which she reached on 31st July last, after battling against westerly winds and gales during the voyage from Cape Town. The winter is reported to have been the most severe and snowy experienced for fourteen years, although the coldest month, September, was yet to come.

The Islands of Tristan dà Cunha are a group of three small volcanic islands in the South Atlantic, in 37° 6′ S., 12° 17′ W., about 2,000 miles west of Cape Town. The name of Tristan is generally restricted to the larger and most northerly island, which has an area of about thirty-two square miles. It is surrounded by precipitous cliffs between one and two thousand feet high.

The group is situated on the southern side of the South Atlantic anticyclonic area, and consequently experiences persistent westerly winds with frequent gales, many rain days and much cloud. The volcanic cone of Tristan reaches a height of 7,600 feet, and is snow-clad until late in summer. Meteorological observations are scanty; the best available, which were taken as long ago as 1816, by Lieut. Rich, are published in the "Challenger" report. The following summary may be of interest :—

1816. Date.	Days of Rain.	Days when landing was impossible.	Temperature.	
			Mean. ° F.	Min. ° F.
August 15-31	14	13	50	42
September 1-30	25	16	55	40
October 1-31	17	17	58	47
November 1-27	16	17	56	43

This gives a total of 72 rain days in 104 days of observation.

Captain Carmichael, who followed Lieut. Rich, did not continue his weather record. He describes, however, the following interesting feature :—

> "The prevailing wind blows from westward and southward. Strong gales are frequent, but rarely continue above twenty-four hours. They never blow quite home to the island, but incline upwards at some distance from the shore, and, striking against the face of the mountains, are beaten back on the lowland in furious whirlwinds."

A mine of information on the island is Parliamentary Paper Cd. 3098, entitled "Further correspondence relating to the Island of Tristan da Cunha," published in 1906.

News in Brief.

International Meteorological Meeting at Venice.—The Italian Meteorological Society announces that during October next, on a date not yet decided, an International Meteorological Meeting will take place at Venice, and an invitation is extended to all interested in the science. Application for membership should be addressed to the Comitato Ordinatore, Osservatorio Servicario Patriarcale, Venice, Italy.

Weather Insurance.—The weather is a very important factor in all outdoor occupations and amusements, and the losses involved when adverse weather conditions are experienced amount annually to very large sums. One has only to consider a few instances, such as a promising hay harvest spoilt by rain, corn crops partially ruined by hail storms, building contracts held up by frost, cricket and football matches, and race meetings abandoned owing to frost, snow or rain, to see that the question of Weather Insurance is of great importance.

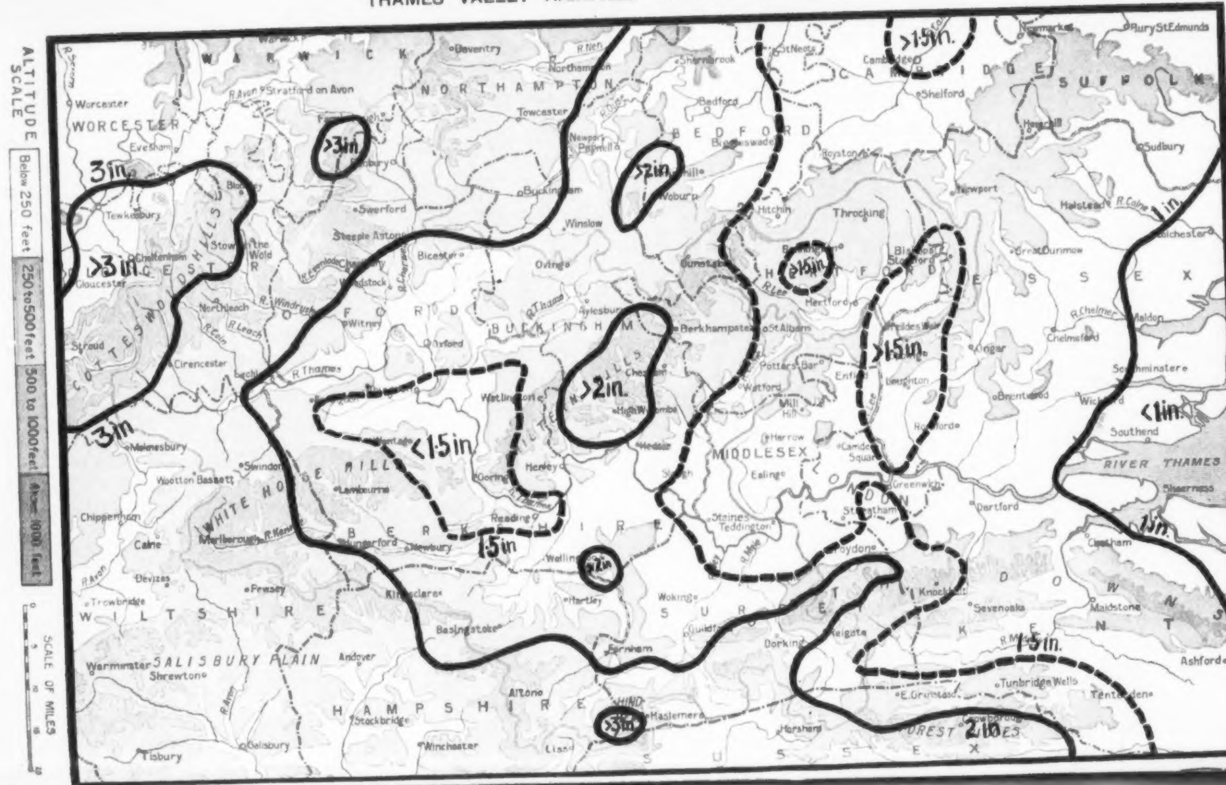
In the past a certain amount of insurance has been effected against such risks, but the premiums have often been prohibitive, owing to the fact that they were based on a small volume of business and that no reliable data of the average weather conditions had been collated.

The Eagle, Star and British Dominions Insurance Company, Limited, has now, however, opened a special Department, named the "Pluvius" Department, for operating in Weather Insurance, and various forms of policies have been prepared, covering as far as possible all insurable weather risks, including the provision of compensation to holiday-makers in the event of excessive rainfall during the insured period. It is anticipated that there will be a large and growing demand for th s form of insurance.

War's Delays.—A tabular statement of the magnetic elements at Irkutsk (1908–9), Katharinenburg (1908–12), and Pawlowsk (1908–9–10) reached the Meteorological Office on March 27th, 1920, together with a covering letter from the late Prince B. Galitzine, dated St. Petersburg, July 23rd, 1914. From a note in the *Times* it would appear that this letter had been detained at Dantzig since the declaration of War. The data referred to are being communicated to *Terrestrial Magnetism.* They are also being published in *Hourly Values, 1917.*

Messrs. Negretti and Zambra announce an exhibition of new meteorological instruments at 38, Holborn Viaduct, E.C.1, from March 29th to April 19th.

THAMES VALLEY RAINFALL MARCH, 1920.



Weather in the British Isles: March 1920.

LIKE the three months which preceded it, March was notable for its unusual mildness. Throughout the month the weather was of a very varied character and, in fact, "March many weathers" behaved in accordance with its reputation. There was however a marked absence of cold, drying winds, for during the greater part of the month there was a preponderance of winds from westerly or south-westerly quarters, winds which were, moreover, frequently accompanied by copious precipitation in the form of snow, sleet, hail, and rain. During the first half of the month snow and sleet were fairly general, but during the latter half these forms of precipitation were comparatively rare. Occasionally the precipitation was accompanied by a good deal of electrical disturbance, especially in the western districts and in Ireland, and towards the end of the month thunder was also heard in some south-eastern and midland localities. There were one or two very sunny days, but, generally speaking, the amount of sunshine was moderate.

Commonly air pressure was higher over the southern part of the British Isles than over the northern, and as a result the weather was much finer in the South than in the North, and on most days the temperature at English stations was several degrees warmer than at the majority of Scottish stations. A striking feature of the month was the frequency of the warm days; at Kew Observatory, for instance, the maximum temperature was between 55° F. and 66° F. on sixteen occasions, and fell below the normal on only five days. From the 21st to 23rd there was an unusually fine spell over the greater part of England, and a maximum of 67° F. was recorded at Raunds, Worksop, Salisbury and Westminster. These warm days had a marked effect on the mean temperature for the week which ended on the 27th; at Cromer the mean was 8·3° F. above the normal, at Norwich and Westminster 7·9° F. above, and at Fulbeck 7·5° F. above.

The coldest weather of the month occurred during the week which ended on the 13th, when the mean temperature was below the normal in all districts. On the 8th, 21° F. was recorded at Eskdalemuir and 22° F. at Balmoral, Kilmarnock, Cally, Cheadle, and Stonyhurst, and on the morning of the 9th the reading at Raunds was as low as 20° F.

An outstanding feature of the month's weather was the passage eastwards across England on the 14th and 15th of a deep secondary depression connected with a low pressure area between Iceland and Scotland. In London at 3 h. on the 15th the barometer fell to 967·5 mb. (28·57 in.), after having fallen continuously for 51 hours since midnight of the 12th, and at 7 h., when the depression was centred over the Humber, the barometer reading at Spurn Head was as low as 965·4 mb. (28·51 in.). The passage of this system caused unsettled weather in most parts, and on 14th and 15th showers of snow, sleet, hail, and rain were common, with gales in many places. In parts of Lincoln, Notts, and Northants the snow fell to a depth of 1 ft.

The rainfall of the month was nearly everywhere in excess of the average, reaching twice the average over considerable areas in Wales. Amounts less than 1 inch occurred however in the extreme east of England. More than 5 inches fell on Dartmoor, over considerable areas in the north-east of England, the west of Scotland and Ireland, and over practically the whole of Wales. More than 10 inches was reached in a number of small areas. The general rainfall expressed as a percentage of the average was:—England and Wales, 150; Scotland, 137; Ireland, 129; British Isles, 139.

In London (Camden Square) there was frequent but light rain. The mean temperature was 46·7° F., or 4·6° above the average, being the highest value recorded for March during the 63 years' record. The maximum shade temperature reached or exceeded 60° F. on as many as 10 days, the highest number previously recorded in March being 8 days in 1893. Duration of rainfall, 35·9 hours. Evaporation, ·78 in.

Rainfall Table for March 1920.

STATION.	COUNTY.	Aver. 1875–1909. in.	1920. in.	1920. mm.	Per cent. of Av.	Max. in 24 hrs. in.	Max. in 24 hrs. Date.	No. of Rain Days.
Camden Square	*London*	1·70	1·42	36	84	·28	14	18
Tenterden (View Tower)	*Kent*	1·95	1·14	29	58	·32	14	17
Arundel (Patching)	*Sussex*	1·95	2·33	59	119	·64	14	16
Fordingbridge (Oaklands)	*Hampshire*	2·09	2·44	62	117	·47	13	21
Oxford (Magdalen College)	*Oxfordshire*	1·45	1·56	40	108	·40	14	16
Wellingborough	*Northampton*	1·72	2·08	53	121	·64	14	18
Hawkedon Rectory	*Suffolk*	1·66	1·58	40	95	·30	14	18
Norwich (Eaton)	*Norfolk*	1·80	1·25	32	69	·23	14	17
Launceston (Polapit Tamar)	*Devon*	2·74	4·14	105	151	·58	13	24
Lyme Regis (Rousdon)	„	2·30	3·33	85	145	·54	29	19
Ross (Birchlea)	*Herefordshire*	2·01	3·41	87	170	·52	14	19
Church Stretton (Wolstaston)	*Shropshire*	2·19	4·08	104	186	·90	14	20
Boston (Black Sluice)	*Lincoln*	1·47	2·31	59	157	·77	15	16
Worksop (Hodsock Priory)	*Nottingham*	1·70	2·22	56	131	·69	15	15
Mickleover Manor	*Derbyshire*	1·69	2·13	54	126	·62	14	15
Southport (Hesketh Park)	*Lancashire*	2·11	3·85	98	182	·76	24	22
Wetherby (Ribston Hall)	*York, W. R.*	1·92	2·34	59	122	·55	14	11
Hull (Pearson Park)	„ *E. R.*	1·84	1·75	44	95	·52	14	16
Newcastle (Town Moor)	*North'land*	2·10	3·26	83	155	·67	24	17
Borrowdale (Seathwaite)	*Cumberland*	10·63	16·60	422	156	..	..	..
Cardiff (Ely)	*Glamorgan*	2·89	4·40	112	152	·62	31	25
Haverfordwest	*Pembroke*	3·16	6·87	174	217	·83	26	26
Aberystwyth (Gogerddan)	*Cardigan*	3·04	7·75	197	255	·80	30	20
Llandudno	*Carnarvon*	2·13	5·27	134	247	·74	26	21
Dumfries (Cargen)	*Kirkcudbrt.*	3·33	6·11	155	184	1·78	27	22
Marchmont House	*Berwick*	2·64	3·71	94	141	·79	15	17
Girvan (Pinmore)	*Ayr*	3·62	5·19	132	143	·85	27	24
Glasgow (Queen's Park)	*Renfrew*	2·61	3·64	92	139	·85	27	21
Islay (Eallabus)	*Argyll*	3·68	3·94	100	107	·47	27	27
Mull (Quinish)	„	4·28	7·08	180	165	·82	5	25
Loch Dhu	*Perth*	6·29	8·45	215	134	1·30	27	21
Dundee (Eastern Necropolis)	*Forfar*	2·06	2·11	54	102	·60	30	18
Braemar	*Aberdeen*	2·87	4·43	112	154	1·25	27	16
Aberdeen (Cranford)	„	2·65	2·65	67	100	·51	15	19
Gordon Castle	*Moray*	2·36	2·86	73	121	·53	15	15
Drumnadrochit	*Inverness*	3·09	3·18	81	103	·43	27	26
Fort William	„	6·39	9·84	250	154	1·75	3	27
Loch Torridon (Bendamph)	*Ross*	7·29	10·05	255	138	1·69	2	24
Stornoway	„	3·85	5·01	127	130	·70	2	26
Dunrobin Castle	*Sutherland*	2·64	3·21	82	122	·60	29	13
Wick	*Caithness*	2·24	3·17	81	142	·64	30	22
Glanmire (Lota Lodge)	*Cork*	3·09	4·27	108	138	·67	25	20
Killarney (District Asylum)	*Kerry*	4·51	6·00	152	133	..	..	..
Waterford (Brook Lodge)	*Waterford*	2·64	4·27	108	162	·75	25	17
Nenagh (Castle Lough)	*Tipperary*	2·99	3·28	83	110	·54	25	20
Ennistymon House	*Clare*	3·24	4·72	120	146	·57	27	23
Gorey (Courtown House)	*Wexford*	2·28	3·61	92	158	1·03	26	15
Abbey Leix (Blandsfort)	*Queen's Co.*	2·59	3·85	98	149	·75	27	19
Dublin (FitzWilliam Square)	*Dublin*	1·98	2·05	52	104	·39	1	19
Mullingar (Belvedere)	*Westmeath*	2·64	2·22	56	84	·45	2	15
Woodlawn	*Galway*	3·01	3·38	86	112	·72	27	24
Crossmolina (Enniscoe)	*Mayo*	4·36	5·77	147	132	·88	5	27
Collooney (Markree Obsy.)	*Sligo*	3·33	4·68	119	141	·77	5	23
Seaforde	*Down*	2·84	3·34	85	118	·43	27	19
Ballymena (Harryville)	*Antrim*	3·07	3·75	95	122	·53	27	22
Omagh (Edenfel)	*Tyrone*	2·98	3·74	95	125	·49	27	24

Supplementary Rainfall, March 1920.

Div.	STATION.	RAIN. in.	RAIN. mm.	Div.	STATION.	RAIN. in.	RAIN. mm.
II.	Ramsgate	·50	13	XII.	Langholm, Drove Rd.	5·92	150
,,	Sevenoaks, Speldhurst	1·35	34	XIII.	Selkirk, Hangingshaw	4·52	115
,,	Hailsham Vicarage	2·20	56	,,	North Berwick Res.	1·88	48
,,	Totland B. Aston Ho.	2·60	66	,,	Edinburgh, Royal Ob.	2·18	55
,,	Ashley, Old Manor Ho.	2·49	63	XIV.	Biggar	4·84	123
,,	Grayshott	3·01	76	,,	Leadhills	10·13	752
,,	Ufton Nervet	1·96	50	,,	Maybole, Knockdon	4·44	113
III.	Harrow Weald, Hill Ho.	1·34	34	XV.	Rothesay	5·54	141
,,	Pitsford, Sedgebrook	2·09	53	,,	Oban	..	..
,,	Chatteris, The Priory	1·43	36	,,	Inveraray Castle	12·23	311
IV.	Elsenham, Gaunts End	1·44	37	,,	Holy Loch, Ardnadam	7·12	181
,,	Lexden, Hill House	·94	24	XVI.	Loch Venachar	4·95	126
,,	Aylsham, Rippon Hall	1·39	35	,,	Glenquey	4·10	104
,,	Swaffham	1·55	39	,,	Loch Rannoch, Dall	5·43	138
V.	Devizes, Highclere	2·27	58	,,	Coupar Angus	3·34	85
,,	Weymouth	2·91	74	,,	Montrose Asylum	1·76	45
,,	Ashburton, Druid Ho.	5·30	135	XVII.	Balmoral Castle	3·61	92
,,	Cullompton	4·24	108	,,	Fyvie Castle	2·20	56
,,	Lynmouth, Rock Ho.	4·78	121	,,	Peterhead, Forehill	3·62	92
,,	Hartland Abbey	4·85	123	,,	Grantown-on-Spey	2·32	59
,,	St. Austell, Trevarna	4·58	116	XVIII.	Cluny Castle	4·32	110
,,	North Cadbury Rec.	2·19	56	,,	Loch Quoich, Loan	28·90	734
VI.	Clifton, Stoke Bishop.	2·77	70	,,	Skye, Dunvegan	7·91	201
,,	Ledbury, Underdown.	2·71	69	,,	Fortrose	2·17	55
,,	Shifnal, Hatton Grange	2·58	66	,,	Ardross Castle	2·80	71
,,	Ashbourne, Mayfield	1·93	49	,,	Glencarron Lodge	10·31	262
,,	Barnt Green, Upwood	2·25	57	XIX.	Tongue Manse	2·41	61
,,	Blockley, Upton Wold	3·45	88	,,	Melvich Schoolhouse	2·40	61
VII.	Grantham, Saltersford	2·32	59	,,	Loch More, Achfary	6·85	174
,,	Louth, Westgate	2·06	52	XX.	Dunmanway Rectory	5·58	142
,,	Mansfield, West Bank	2·29	58	,,	Mitchelstown Castle	3·76	96
VIII.	Nantwich, Dorfold Hall	3·14	80	,,	Gearahameen	10·00	254
,,	Bolton, Queen's Park.	4·09	104	,,	Darrynane Abbey	6·24	158
,,	Lancaster, Strathspey.	5·14	131	,,	Clonmel, Bruce Villa	4·40	112
IX.	Wath-upon-Dearne	1·63	41	,,	Cashel, Ballinamona	3·66	93
,,	Bradford, Lister Park.	2·73	69	,,	Roscrea, Timoney Pk.	3·14	80
,,	West Witton	4·23	107	,,	Foynes	3·52	89
,,	Scarborough, Scalby	2·65	67	,,	Broadford, Hurdlesto'n	4·03	102
,,	Ingleby, Greenhow	3·10	79	XXI.	Kilkenny Castle	3·71	94
,,	Mickleton	3·40	86	,,	Rathnew, Clonmannon	4·31	110
X.	Bellingham	3·00	76	,,	Hacketstown Rectory	4·08	104
,,	Ilderton, Lilburn	3·65	93	,,	Ballycumber, Moorock	2·64	67
,,	Orton	7·28	185	,,	Balbriggan, Ardgillan	2·31	59
XI.	Llanfrechfa Grange	4·45	113	,,	Drogheda	2·30	58
,,	Treherbert, Tyn-y-waun	10·34	263	,,	Athlone, Twyford	4·09	104
,,	Carmarthen Friary	7·05	179	,,	Castle Forbes Gdns.	3·19	81
,,	Fishguard	6·44	164	XXII.	Ballynahinch Castle	4·95	126
,,	Lampeter, Falcondale	8·47	215	,,	Westport House	5·19	132
,,	Abergwngy	7·40	188	XXIII.	Enniskillen, Portora	3·13	80
,,	Crickhowell, Talymaes	7·00	178	,,	Cootehill, Dartrey	3·59	91
,,	Sennybridge	7·44	155	,,	Armagh Observatory	3·20	81
,,	Lake Vyrnwy	6·09	132	,,	Warrenpoint	3·23	82
,,	Llangynhafal, P. Drâw	5·21	231	,,	Belfast, Cave Hill Rd.	3·28	83
,,	Dolgelly, Bryntirion	9·11	178	,,	Glenarm Castle	4·70	119
,,	Lligwy	6·49	165	,,	Londonderry, Creggan.	3·93	100
XII.	Stoneykirk, Ardwell Ho.	3·49	89	,,	Sion Mills	..	..
,,	Gatehouse, Cally	5·53	140	,,	Milford, The Manse	4·13	105
,,	Carsphairn, Shiel	8·33	212	,,	Killybegs, Rockmount	6·13	156

Climatological Table for the

STATIONS (Those in italics are South of the Equator)	PRESSURE: Mean M.S.L. (mb.)	PRESSURE: Diff. from Normal (mb.)	TEMPERATURE, Absolute: Max. (° F.)	Date	TEMPERATURE, Absolute: Min. (° F.)	Date	TEMPERATURE, Mean Values: Max. (° F.)	Mean Values: Min. (° F.)	Mean Values: ½ max. and min. (° F.)	Mean Values: Diff. from Normal (° F.)
London, Kew Observatory	1021·7	+8·0	65	1	28	23	53·6	37·0	45·3	−4·6
Gibraltar	1018·3	+3·0	78	3	48	28, 29	69·5	56·7	63·1	−3·3
Malta	1016·7	−0·7	91·0	14	50·5	24	75·2	64·4	69·8	−0·9
Sierra Leone	1013·1	+1·4	90	17	61	2, 4, 7	86·4	70·4	78·4	−1·8
Lagos	..	..	87	3	70	15	84·0	73·8	78·9	−0·3
Kaduna, N. Nigeria	*944·3	..	91	17	63	8	86·6	66·5	76·5	..
Cape Town	..	..	89·2	10	45·5	3	71·2	52·4	61·8	+0·8
Johannesburg	..	..	86·3	23	43·1	20	78·9	53·0	65·9	+4·9
Mauritius	1018·2	+0·2	84·4	31	57·0	1	79·9	64·0	72·0	−0·6
Bloemfontein	..	..	90·4	12	35·2	14	85·7	51·2	68·5	+3·3
Calcutta, Alipore Obsy.	..	..	92·8	2	56·9	28	89·0	74·3	81·7	+1·3
Bombay	..	..	92·0	30	76·4	21	88·8	77·9	83·3	+1·3
Madras	..	..	96·2	8	73·1	23	89·2	76·3	82·7	+0·7
Colombo, Ceylon	..	..	87·8	23	72·7	27	85·7	76·0	80·9	−0·1
Hong Kong	1014·2	+0·6	84·7	3	59·3	22	78·5	71·0	74·7	−2·1
Sydney	..	..	..	..	..	..	..	..	..	..
Melbourne	..	..	94·4	30	37·0	4	69·1	49·1	59·1	+1·5
Adelaide	..	..	102·8	30	40·6	25	73·5	51·7	62·6	+0·7
Perth	..	..	76·0	21	44·0	11	66·1	51·2	58·7	−2·3
Coolgardie	..	..	94·5	25	36·8	7	74·5	48·9	61·7	−1·8
Brisbane	..	...	92·4	9	54·3	4	79·6	60·2	69·9	+0·2
Hobart, Tasmania	..	..	81·4	30	37·1	3	64·3	47·7	56·0	+2·0
Wellington	1014·3	+2·3	68·8	27	40·7	16	60·4	48·4	54·4	+0·3
Suva, Fiji	1016·3	+1·7	88·4	5	63·4	17	80·3	69·8	75·1	−0·[illegible]
Jamaica, Kingston	1012·2	+0·9	92·5	7	69·6	31	88·6	72·6	80·6	+0·1
Grenada	1011·4	+0·3	90·0	2	72·0	10, 27, 28	86·0	74·9	80·5	+0·[illegible]
Toronto	..	..	80·0	3	31·8	8	61·5	44·6	53·1	+4·[illegible]
Fredericton	..	..	65·0	15	17·0	21	53·4	32·9	43·1	0
St. John, N.B.	..	..	64·4	7	24·3	30	51·5	38·8	45·1	−2·[illegible]
Victoria, B.C.	..	..	67·2	6	31·7	25	53·9	42·4	48·1	−3·[illegible]

* At Station Level, height of 2088 feet.

LONDON, KEW OBSERVATORY.—9 days of fog.

SIERRA LEONE.—7 thunderstorms, 5 days of gale.

Mauritius.—Prevailing wind ESE ; mean speed, 5·4 mi/hr.

Bloemfontein.—Still experiencing severest drought on record.

HONG KONG.—Prevailing wind ENE ; mean speed, 11·5 mi/hr.

ritish Empire, October 1919.

TEMPERATURE				PRECIPITATION						
Mean Values		Absolute		Amount		Diff. from Normal	Days	Mean Cloud Am'nt	Bright Sun-shine	STATIONS Those in italics are South of the Equator.
Dew Point °F.	R'tive Humidity %	Max. in Sun °F.	Min. on Grass °F.	in.	mm.	mm.			Hours per day	
0·3	79	117·0	20·1	0·6	15	− 54	9	5·2	3·94	London, Kew Observatory.
5·0	76	144	41	6·01	153	+ 66	7	3·1	..	Gibraltar.
..	73	139	..	0·99	25	− 55	4	6·5	6·3	Malta.
3·8	81	..	..	6·50	165	−169	22	5·9	..	Sierra Leone.
4·5	79	161·5	56·5	8·96	228	+ 27	19	7·9	..	Lagos.
0·1	86	..	..	1·49	38	− 22	9	2·6	..	Kaduna, N. Nigeria.
1·2	67	..	..	0·32	8	− 36	2	4·1	..	*Cape Town.*
3·9	52	..	41·3	1·52	39	− 26	10	2·5	9·40	*Johannesburg.*
1·0	70	..	50·5	1·26	32	− 3	10	6·6	..	*Mauritius.*
3·1	41	..	..	0·65	17	− 26	5	3·2	..	*Bloemfontein.*
3·0	77	..	59·0	0·46	12	− 87	1	4·0	..	Calcutta, Alipore Obsy.
4·4	77	140·2	68·1	1·40	36	− 11	4	2·6	..	Bombay.
4·7	82	163·0	67·9	10·80	274	− 12	16	5·7	..	Madras.
3·8	82	164·0	70·6	12·47	317	−171	26	7·7	..	Colombo, Ceylon.
4·8	72	..	..	4·69	119	− 4	9	5·8	5·5	Hong Kong.
..	..	..	..	..	..	..	..	..	..	*Sydney.*
4·6	56	144·2	29·6	1·64	42	− 24	11	6·3	..	*Melbourne.*
6·8	52	155·5	28·4	0·77	20	− 24	10	5·8	..	*Adelaide.*
9·1	70	144·4	34·4	2·18	55	+ 1	14	5·3	..	*Perth.*
2·9	45	152	34·2	0·63	16	− 2	6	3·8	..	*Coolgardie.*
5·9	61	147·6	47·1	0·86	22	− 47	5	3·1	..	*Brisbane.*
3·2	59	137·6	29·2	1·82	46	− 11	15	6·6	..	*Hobart, Tasmania.*
6·9	76	139·0	28·8	1·98	50	− 58	9	5·9	6·87	*Wellington.*
1·0	84	..	..	17·10	434	+235	21	7·5	..	*Suva, Fiji.*
2·2	84	..	..	7·63	194	+ 4	12	6·3	..	Jamaica, Kingston.
2·7	77	141	..	9·10	231	+ 47	19	3·7	..	Grenada.
5·9	85	112·2	27·0	2·98	76	+ 7	18	5·8	..	Toronto.
5·5	75	..	..	4·22	107	+ 4	9	5·5	..	Fredericton.
9·0	72	126·2	18·5	3·86	98	− 7	13	6·0	..	St. John, N.B.
2·0	82	120·0	26·0	1·30	33	− 24	12	5·8	..	Victoria, B.C.

Adelaide.—Absolute maximum highest on record for October.

Wellington.—2 sunless days, 5 days of frost.

Suva, Fiji.—2 thunderstorms.

JAMAICA, KINGSTON.—The rainfall, taking the island as a whole, was below the average.

GRENADA.—3 thunderstorms.

Weather Abroad: March 1920.

In Western Europe March was not so disturbed as February, but in the British Isles and eastward into the Baltic the weather continued unusually warm, and at Helsingfors and Revel the sea was unusually free from ice. Early in the month a gale in the Baltic caused loss of life. In France the warm weather was interrupted for a few days by a cold spell about the 11th. Heavy rainfall occurred in Switzerland and Italy as well as in France; at Lugano 100 mm. fell on the 15th and 16th and 64 mm. on the 30th and 31st. From Madeira 66 mm. was reported on the 2nd.

The cold and stormy conditions of February in the near East continued into March, with an intensity unequalled for many years, culminating about the 9th in a hurricane in the Black Sea, which destroyed an American Red Cross steamer, with the loss of 500 invalided soldiers.

America was visited by several severe storms which crossed the northern part of the United States from west to east. One of these appeared off San Francisco on the 1st and reached New Brunswick with greatly increased intensity on the 7th. In the rear of this storm heavy snowfall and blizzards visited the Middle West and Chicago. All traffic was interrupted for some time and much damage done. The same storm caused a gale estimated at 70 m.p.h. in New York Harbour, seriously damaging the "Cedric" and destroying many light craft.

The next depression appeared on the 13th and developed into a severe storm west of the Lake Region, causing damage especially in Kentucky and in Quebec and the Atlantic Provinces of Canada. Finally on the 28th two destructive tornadoes visited respectively the neighbourhood of Chicago and the borders of Georgia and Alabama. The disturbance near Chicago was very destructive, resulting in 188 deaths and thousands of injured. It appeared first at Elgin, thirty miles west of Chicago, where it wrecked the centre of the town, passing on to the residential suburb of Wilmette, north of Chicago. This tornado is noteworthy as being unusually early in the year. In Georgia the towns of Lagrange and West Point were destroyed, with at least twenty-five deaths.

Geostrophic Wind at London; May, 1881–1915.

FREQUENCY OF STRENGTH AND DIRECTION.

Estimates based on the D.W.R. charts (8h., 1881–1908; 7h., 1909–1915).

Direction.	5 m/s. 11 mi/hr.	10 m/s. 22 mi/hr.	15 m/s. 33 mi/hr.	20 m/s. 44 mi/hr.	Over 20 m/s. Over 44 mi/hr.	Total Frequency of Direction.
N.	29	27	18	5	4	83
NE.	24	72	21	6	—	123
E.	13	30	35	16	3	97
SE.	29	22	10	2	1	64
S.	13	21	9	4	—	47
SW.	23	57	36	16	5	137
W.	22	66	53	19	9	169
NW.	21	30	21	11	2	85
Total Frequency of Strength	174	325	203	79	24	805

Indeterminate—280.

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